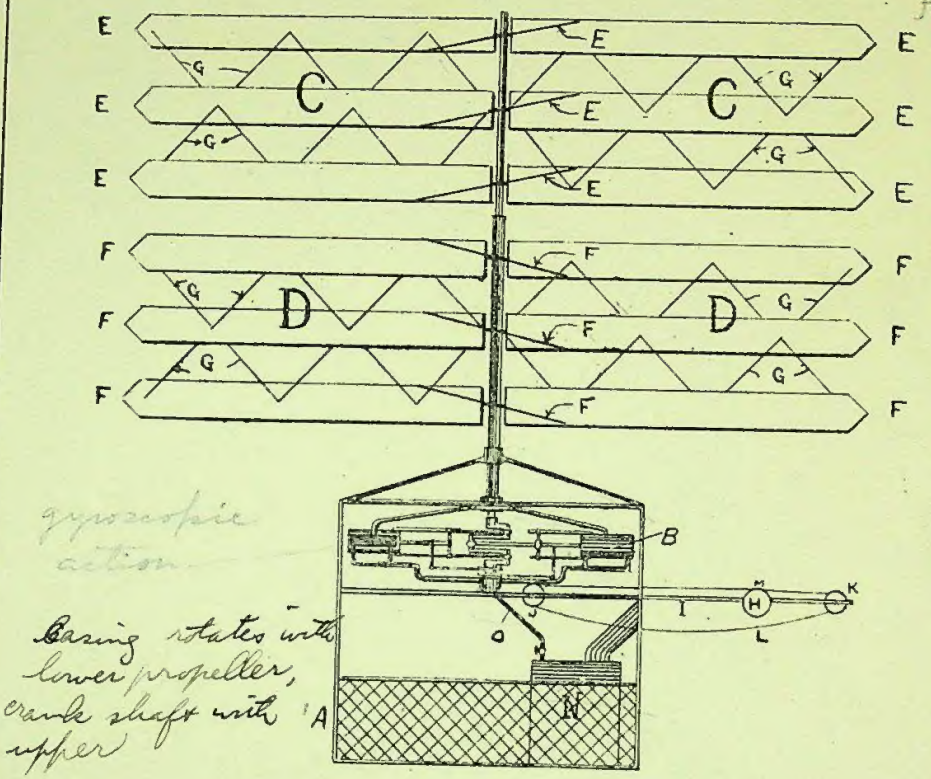
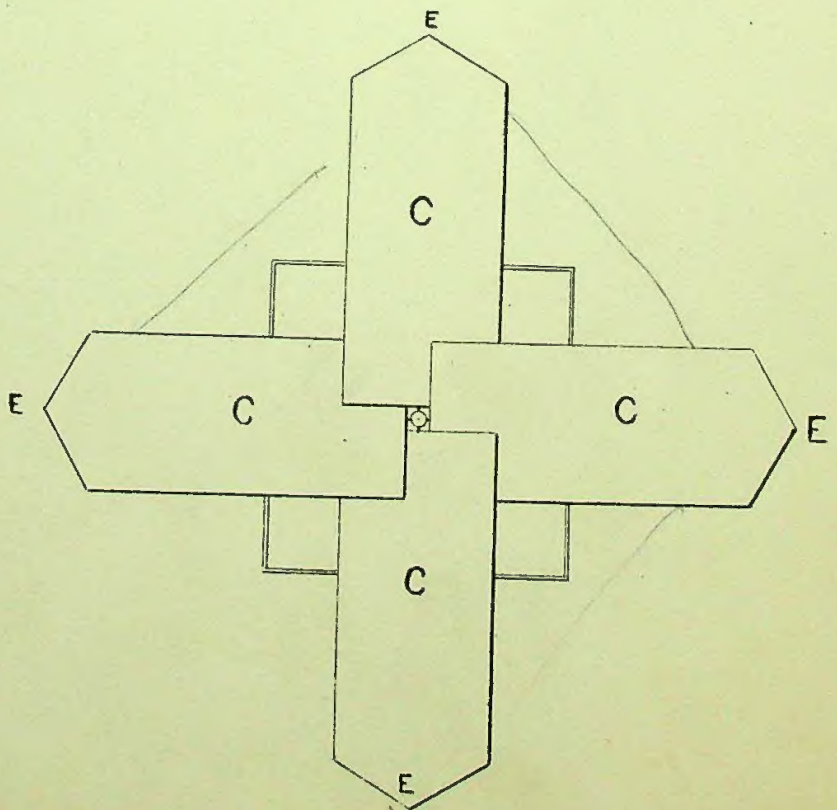
A.D. 1899. Sep. 6. N:o 17,977.

WALKER'S Complete Specification. (1 SHEET)



gyroscopic action

Casing rotates with lower propeller, crank shaft with upper



[This Drawing is a reproduction of the Original on a reduced scale]

N° 17,977 A.D. 1899

Date of Application, 6th Sept., 1899
Complete Specification Left, 2nd June, 1900—Accepted, 4th Aug., 1900

PROVISIONAL SPECIFICATION.

Improvements in Flying Machines.

I, WILLIAM GEORGE WALKER, of 47, Victoria Street, in the City of Westminster, Civil Engineer, do hereby declare the nature of this invention to be as follows:—

I propose to lift my aerial machine by means of screws or rotary aeroplanes mounted on upright vertical shafts, so that the screws or aeroplanes revolve in a horizontal plane when lifting. The screws may have four or more blades, the blades fixed one above the other and connected together by diagonal struts and ties the blades are of sufficient vertical distance apart to allow of the free passage of the air, the object in placing a blade immediately above another blade is to increase the strength and stiffness of the blades, a pair of blades are thus, from a structural point of view similar to a "warren or lattise girder" supported at one end, the upper and lower blades of one pair constituting the upper and lower flanges of the girder respectfully, when the screws are lifting the members of the upper blade are in compression and the lower one in tension, more than two blades may be placed above each other and connected together by ties and struts, the ties and struts should offer as small a resistance to the air as possible, I prefer to make the structure of the blades of steel tubes brazed together by suitable sockets and tied by wire, the framing being covered by canvass or other suitable material.

A screw may be used arranged with the pair of blades as above revolving in one direction, mounted on a vertical shaft, or a couple of screws may be employed revolving in the opposite directions on the same axis driven by steam, oil, gas, or electric motors, one above the other by means of a hollow shaft having another internal shaft revolving in the other direction so that the two screws may react against each other. I propose to fix the framing of the steam or oil engine to the outer shaft, and the crank shaft of the engine to the inner shaft, by this means the framing of the engine not being fixed relatively to its crank shaft, as is the case in the ordinary engines, but only fixed to the outer shaft, the engine framing, cylinders, guides, crossheads, pipes *etc.* will revolve due to the reaction of the connecting rod. Therefore the crank shaft will revolve in one direction, and the engine not being fixed relatively to its shaft as in the ordinary way will rotate in the opposite direction. I prefer to place the cylinders exactly opposite each other so as to produce a balance. The cylinder, framing, and reciprocatory parts, revolve therefor with the screw connected to the outer shaft and the crank shaft with the screw connected to the inner shaft.

These revolving engines act as a gyroscope and gives stability to the machine, by means of the inertia in revolving weight of the engines.

In the case of electric motors, the armature would be connected to the inner

shaft and the field magnets to the outer one, so that the armature will revolve in the same direction as one shaft and the field magnets with the other shaft.

I employ a cage or car freely suspended to the main shafting by suitable ball or other bearings and which does not revolve, on the cage may be placed the steam boiler from which steam is supplied to the revolving engines by means of a suitable stuffing box or trunnion. To prevent the rotation of the cage it may be partially connected when necessary either to the outer shaft or the inner shaft by means of friction gear.

Where steam is used I prefer to place the condenser on the revolving blades the exhaust steam being taken up the vertical shaft.

I can if desired rotate the screws by means of supplementary screws placed at the tips of the blades having their axis horizontal and tangential to the tips of the or by means of jet propulsion reacting tangential at the tips of the blades, the jet propulsion may be either steam or caused by an explosive mixture. With screws revolving by means of supplementary propellers or jets, there will be no necessity to employ screws revolving in the opposite direction as the supplementary propellers or jets at the tips will in themselves produce the necessary reaction. A jet or supplementary propeller may be employed to prevent the cage or car revolving with the shaft; or when a single screw is employed, reaction may be obtained by a supplementary screw acting on the end of a cantilever.

I propose to navigate my machine by tilting the axis out of the vertical, *i.e.* by altering the centre of gravity, by means of a sliding weight or weights attached to a suitable bar, this bar together with the weight may be revolved to any particular vertical plane of the compass and the weight moved out or in, tilting the disc plane of the screws to any desired angle which will give the machine a horizontal motion either when rising or falling

I can also navigate my machine by means of rudders which may be tilted either in a vertical or horizontal plane.

The disc area of the revolving screws approximates a single aeroplane of the equivalent area. And in order to utilize the power of the winds as far as possible. I propose to introduce considerable area in the central part of the screws which area may be in a plane or planes at right angles to the axis of the screws, in which case I rely on the outer portions of the screw blades for lifting purposes.

Dated this 5th day of September 1899.

W. G. WALKER.

COMPLETE SPECIFICATION.

Improvements in Flying Machines.

I, William George Walker, of 47, Victoria Street, in the City of Westminster, Civil Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

I propose to lift my flying machine by means of screws or rotary aeroplanes mounted on vertical shafts. I construct the screws with the blades arranged so that they do not all revolve in the same plane. In order to explain my meaning suppose we fix an ordinary screw-propeller of four blades on to a vertical shaft, in which case all the blades will revolve in the same horizontal plane, then place another similar screw-propeller on the same shaft and at a convenient distance above the other one and it will rotate in a different horizontal

plane, now rotate the upper screw-propeller until its blades are just over the blades of the lower one so that the respective four blades of the upper propeller are in the same vertical planes as the respective blades of the lower one but with a space between the respective propellers, then fix both propellers. We now have a single eight bladed screw-propeller made up of two four bladed ones, consisting of four sets of two superimposed blades, in the same manner we can fix a third similar screw-propeller which would form a propeller consisting of four sets of three superimposed blades or twelve blades in all. If necessary the propellers may be fixed so that the superimposed blades are not in the same vertical plane.

In my aerial screw-propeller I connect the different superimposed blades together by struts and ties whereby the strength is very much increased: in the case of an ordinary screw-propeller employed for aerial work and where the blades are of considerable length and yet must be as light as possible they tend to bend and break off at the roots of the blades, this difficulty is to a great extent overcome by arranging the blades superimposed so that they can be conneted together by struts and ties after the manner of a lattice girder, so that a set of two superimposed blades are from a structural point of view somewhat similar to an ordinary lattice girder fixed at one end. The struts and ties should offer as small a resistance as possible to the air. The main object in the above arrangement of superimposed blades is that they shall be as stiff and strong as possible for a minimum amount of weight. I prefer to construct the propeller with as many blades as possible arranged superimposed as before discribed so that I can obtain a large blade area with small diameter propeller.

I prefer to make the structure of the blades of steel tubes brazed together by suitable sockets and tied by wire, the framing being covered by canvass or other suitable material. A screw may be used having blades as above revolving in one direction mounted on a vertical shaft, or a couple of screws may be employed revolving in the opposite directions on the same axis driven by steam oil gas or electric motors one above the other by means of a hollow shaft having another internal shaft revolving in the other direction so that the two screws may react against each other.

I propose to fix the framing of the steam or oil engine to the outer shaft and the crank shaft of the engine to the inner shaft, by this means the framing of the engine not being fixed relatively to its crank shaft as in the case with the ordinary engine but only fixed to the outer shaft the engine framing cylinders and other parts will revolve due to the reaction of the connecting rod, therefor the crank shaft will revolve in one direction and the engine in the other. I prefer to place the cylinders exactly opposite each other so as to produce a balance. The cylinders framing reciprocatory parts, revolve therefore with the screw connected to the outer shaft and the crank shaft with the screw connected to the inner one or the framing may be connected to the inner shaft and the crank shaft to the other one. These revolving engines act as a gyroscope and gives stability to the machine, by reason of the revolving weight of the engine acting like a fly wheel. In some cases where I drive the propellers by gearing I fix the crank shaft and allow the cylinders to rotate instead, this is a great advantage especially in the case of oil or gas engines of the Otto cycle as it dispenses with the flywheel and the cylinders are kept cool by their revolving motion through the air. In the case of electric motors the armature would be connected to the inner shaft and the field magnets to the outer one or *vice versa*.

I employ a cag or car freely suspended to the main shafting by suitable ball or other bearings and which does not revolve, on the cage may be placed the steam boiler from which steam is supplied to the revolving engines by means of a suitable stuffing box or trunnion. To prevent the rotation of the cage it may be partially connected when necessary either to the outer shaft or inner shaft by means of friction or other suitable gear.

Where steam is used I prefer to place the condenser on the revolving blades the exhaust steam being taken up the vertical shaft.

I can if desired rotate the screws by means of supplementary screws at the tips of the blades having their axis horizontal and tangential to the tips of the blades, or by means of jet propulsion reacting at the tips of the blades. The jet propulsion may be either steam or caused by an explosive mixture. With screws revolving by means of supplementary propeller or jets, there will be no necessity to employ screws revolving in opposite directions as the supplementary propellers produce the necessary reaction.

A jet or supplementary propeller may be employed to prevent the car from revolving with the shaft, or when a single screw is employed reaction may be obtained by a supplementary screw acting at end of a lever, or by a suspended vane or surface at right angles to the axis of the propellers.

I propose to navigate my machine by tilting the axis out of the vertical, *i.e.* by altering the centre of gravity, by means of a sliding weight or weights attached to a suitable bar, this bar to-gether with the weight may be revolved to any particular vertical plane of the compass and the weight moved out or in, tilting the disc plane of the screws to any desired angle which will give the machine a horizontal motion either when rising or falling. I also navigate my machine by means of rudders which may be tilted either in a vertical or horizontal plane. The disc area of the screws approximates an aeroplane of equivalent area. And in order to utilize the power of the winds as far as possible I propose to introduce considerable area in the central part of the screws which may be a circular plane or disc at right angles to axis of the screw, in which case I rely on the outer portions of the screw blades for lifting purposes.

The drawing shews the plan and elevation of the flying machine with two propellers revolving in opposite directions about the same axis, each propeller has twelve blades arranged in four sets of three superimposed blades the lower propeller is connected to the outer shaft which is attached to the engine framing and the upper one to the inner one which is connected to the crank shaft. A is the cradle B the motors.

Referring to the drawing C C is a propeller connected to the inner shaft D D being another one connected to the outer shaft, each of these propellers are composed of four sets of three superimposed blades or twelve blades each. The superimposed blades of the top propeller are lettered E E E—and the lower one F F F. The struts and ties connecting the different superimposed blades are shewn by the inclined lines lettered G G.

H is the ballance weight for steering the flying machine. When the propellers are rotating in a horizontal plane, the apparatus will be lifted in a vertical direction and when the speed of the screws is sufficiently reduced it will also descend in a vertical direction. If however the axis of the propellers is tilted out of the vertical so that the disc area of the propellers is inclined to the horizontal plane, then if the machine is caused to descend by the reduction of speed of the propellers it will tend to glide down an inclined plane due to the angle at which the discs of the propellers are inclined. In the drawing the bar I is attached to the cradle and at right angles to the axis of the propellers.

K is a pulley fixed at the end of the bar I and J is another pulley near the centre of the cradle, L is a cord attached to the ballance weight at M and passing round the two pulleys. By rotating pulley J either in one or the other direction the weight M can be moved to any position on the bar and the axis of the propellers thereby tilted, when moved to a position at the extreme end of the bar near K the propellers will be tilted to their greatest angle. The cradle is freely suspended and may be turned by partial connection with one of the revolving shafts so that the bar I points in any direction and if the weight is then moved out tilting the machine it will when descending travel in the direction at which the bar points. N is the boiler O the steam pipe.

I can if necessary navigate and control the flying machine from the ground either by electrical or other mechanical means, and the necessary electric energy for the motors may be supplied from the ground.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:—

(1) Constructing an air-propeller with blades fixed in different planes having regard to the plane of rotation.

(2) A steam oil or gas or electric motor where the cylinders or fields rotate in an opposite direction to the crank shaft or armature.

(3) A cradle which is prevented from rotating by partial connection to one or the other of the two shafts.

(4) An aerial propeller which contains a disc of surface in centre of propeller, substantially as herein described.

Dated this 1st day of June 1900.

W. G. WALKER.

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Fowler
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